OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **Robinson Pond, Hudson,** the program coordinators have made the following observations and recommendations.

Thank you for your continued hard work sampling the pond this year! Your monitoring group sampled the deep spot **four** times this year and has done so for many years! As you know, conducting multiple sampling events each year enables DES to more accurately detect water quality changes. Keep up the good work!

The New Hampshire Department of Environmental Services (DES), in conjunction with the U.S. Environmental Protection Agency (EPA) and the environmental consulting firm AECOM, conducted a Total Maximum Daily Load (TMDL) for total phosphorus for your pond. The TMDL refers to the pollutant reductions a waterbody needs to meet New Hampshire's water quality standards. Robinson Pond was listed on the 2008 impaired waters [303(d)] list because elevated algal growth impaired the primary contact recreation (swimming) use. Phosphorus is the nutrient responsible for algal growth and is the pollutant to be reduced to control algal growth. DES is required by the Federal Clean Water Act (CWA), Section 303(d), to report every two years to the EPA on all waters not meeting state water quality standards.

The TMDL conducted at your pond identified an in-lake target phosphorus value that, when met, should result in no additional primary contact recreation impairments due to algal growth. A phosphorus budget was constructed, phosphorus sources identified and phosphorus reductions allocated to each of the sources to meet the target value. An implementation plan provides recommendations on watershed remediation activities to reduce phosphorus inputs to the pond.

The draft TMDL will be provided to your pond association, town, and watershed stakeholders for review and will also be available on the DES website at www.des.nh.gov/organization/divisions/water/wmb/tmdl/index.htm. There will be a period for public review and comment, anticipated for Winter/Spring 2010. Phosphorus load reductions can only occur with the knowledge, participation and action of watershed residents, businesses and stakeholders. If you are interested in learning more about the TMDL Program please contact Peg Foss, TMDL Coordinator, at Margaret.foss@des.nh.gov or 603-271-5448.

Volunteers from your pond participated in the Lake Host™ Program this year. The Lake Host™ Program is funded through DES and Federal grants. The program was developed in 2002 by NH LAKES and NHDES to educate and prevent boaters from spreading exotic aquatic plants to ponds in New Hampshire. Since then, the number of participating ponds and volunteers has doubled, the number of boats inspected has tripled, and the number of "saves" (exotic plants discovered) has increased from four in 2002 to a total of 297 in 2009. The program is invaluable in educating boaters and protecting NH's waterbodies from exotic aquatic plant infestations, thereby preventing recreational hazards, property value decline, aquatic ecosystem decline, aesthetic issues, and saving costly remediation efforts. Lake Host™ staff made **hundreds** of "saves" at your pond and discovered the following aquatic vegetation entering or leaving your pond in 2009:

Native milfoil (native)
Variable milfoil (exotic)
Fanwort (exotic)
Water naiad (native)
Watershield (native)
Waterweed (native)
White lily (native)
Bladderwort (native)
Pondweed (native)
Water marigold (native)

Great work! We encourage volunteers to continue participating in the Lake Host™ Program to protect the future of your pond.

FIGURE INTERPRETATION

CHLOROPHYLL-A

- **Figure 1 and Table 1:** Figure 1 in Appendix A shows the historical and current year chlorophyll-a concentration in the water column. Table 1 in Appendix B lists the maximum, minimum, and mean concentration for each sampling year that the pond has been monitored through VLAP.

  Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Algae (also known as phytoplankton) are typically microscopic, chlorophyll producing plants that are naturally occurring in lake ecosystems. The chlorophyll-a concentration measured in the water gives biologists an estimation of the algal concentration or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m^3.**

The current year data (the top graph) show that the chlorophyll-a concentration ***decreased slightly*** from **May** to **June**, ***increased*** from **June** to **July**, and then ***decreased*** from **July** to **September**. The **July** chlorophyll concentration was **13.55 mg/m^3** indicating an algal or cyanobacteria bloom potentially occurred in the pond. Typically, chlorophyll concentrations above **15.00 mg/m^3** are indicative of an algal bloom.

The historical data (the bottom graph) show that the **2009** chlorophyll-a mean is ***greater than*** the state and similar lake medians. For more information on the similar lake median, refer to Appendix F.

Overall, the statistical analysis of the historical data (the bottom graph) shows that the mean annual chlorophyll-a concentration has ***not significantly changed*** since monitoring began. Specifically, the mean annual chlorophyll-a concentration has ***fluctuated between approximately 8.31 and 25.83 mg/m^3,*** but has ***not continually increased or decreased*** since **2000**. Please refer to Appendix E for a detailed statistical analysis explanation and data print-out.

While algae are naturally present in all lakes and ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes and ponds, phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

TRANSPARENCY

- **Figure 2 and Tables 3a and 3b:** Figure 2 in Appendix A shows the historical and current year data for transparency with and without the use of a viewscope. Table 3a in Appendix B lists the maximum, minimum and mean transparency data without the use of a viewscope and Table 3b lists the maximum, minimum and mean transparency data with the use of a viewscope for each year that the pond has been monitored through VLAP.

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural lake color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

The current year data (the top graph) show that the non-viewscope in-lake transparency ***increased slightly*** from **May** to **June**, ***decreased slightly*** from **June** to **July**, and then ***increased*** from **July** to **September**.

It is important to note that as the chlorophyll concentration ***decreased*** from **May** to **June**, the transparency ***increased***, and as the chlorophyll ***increased*** from **June** to **July**, the transparency ***decreased***, and as the chlorophyll ***decreased*** from **July** to **September**, the transparency ***increased***. We typically expect this ***inverse*** relationship in lakes. As the amount of algal cells in the water increases, the depth to which one can see into the water column typically decreases, and vice-versa.

The historical data (the bottom graph) show that the **2009** mean non-viewscope transparency is ***slightly less than*** the state median and is ***approximately equal to*** the similar lake median. Please refer to Appendix F for more information about the similar lake median.

The current year data (the top graph) show that the viewscope in-lake transparency was ***greater than*** the non-viewscope transparency on the **June** sampling event. The transparency was ***not*** measured with the viewscope on the **May, July** or **September** sampling events. A comparison of transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. At some point in the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

Overall, the statistical analysis of the historical data (the bottom graph) shows that the mean annual in-lake non-viewscope transparency has ***not significantly changed*** (either *increased* or *decreased*) since monitoring began. Specifically, the in-lake transparency has remained ***relatively stable, ranging between approximately 2.16 and 3.40 meters*** since **2000**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts to stabilize stream banks, lake and pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake or pond should continue on an annual basis. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

TOTAL PHOSPHORUS

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has been sampled through VLAP.

  Phosphorus is typically the limiting nutrient for vascular aquatic plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a lake or pond can lead to increased plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

  The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***decreased*** from **May** to **June**, and then ***increased*** from **June** to **September**.

  The historical data show that the **2009** mean epilimnetic phosphorus concentration is ***slightly greater than*** the state and similar lake medians. Refer to Appendix F for more information about the similar lake median.

  The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***increased*** from **May** to **September**.

  The hypolimnetic (lower layer) turbidity sample was ***elevated*** on the

June, July and September sampling events (**3.66, 2.79 and 19.3 NTUs**). This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the pond bottom is covered by an easily disturbed thick organic layer of sediment. Or, a layer of cyanobacteria was present at that depth. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The historical data show that the **2009** mean hypolimnetic phosphorus concentration is ***much greater than*** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

Overall, the statistical analysis of the historical data shows that the epilimnetic (upper layer) phosphorus concentration has ***not significantly changed*** (either *increased* or *decreased*) since monitoring began. Specifically, the mean annual epilimnetic phosphorus concentration has remained ***relatively stable, ranging between approximately 12 and 17 ug/L*** since **2000**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

Overall, the statistical analysis of the historical data shows that the hypolimnetic (lower layer) phosphorus concentration has ***not significantly changed*** since monitoring began. Specifically, the mean annual hypolimnetic phosphorus concentration has ***fluctuated between approximately 26 and 64 ug/L*** but has ***not continually increased or decreased*** since **2000**.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively impact the ecology and the recreational, economical, and ecological value of lakes and ponds.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**
  Table 2 in Appendix B lists the current and historical phytoplankton and/or cyanobacteria observed in the pond. Specifically, this table lists the three most dominant phytoplankton and/or cyanobacteria observed in the sample and their relative abundance in the sample.

The dominant phytoplankton and/or cyanobacteria observed in the **May** sample were ***Tabellaria*** **(Diatom)**, ***Cyclotella*** **(Diatom)**, and ***Anabaena*** **(Cyanobacteria)**.

The dominant phytoplankton and/or cyanobacteria observed in the **June** sample were ***Ceratium*** **(Dinoflagellate)**, ***Anabaena*** **(Cyanobacteria)**, and ***Synura*** **(Golden-Brown)**.

The dominant phytoplankton and/or cyanobacteria observed in the **July** sample were ***Tabellaria*** **(Diatom)**, ***Oscillatoria*** **(Cyanobacteria)**, and ***Ceratium*** **(Dinoflagellate)**.

The dominant phytoplankton and/or cyanobacteria observed in the **September** sample were ***Asterionella*** **(Diatom)**, ***Aphanizomenon*** **(Cyanobacteria)**, and ***Tabellaria*** **(Diatom)**.

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire’s less productive lakes and ponds.

- **Table 2: Cyanobacteria**
  The cyanobacterium ***Anabaena, Oscillatoria and Aphanizomenon*** was observed in the plankton samples throughout the season. ***These cyanobacteria, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans***. Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding cyanobacteria.

  Also, a cyanobacteria bloom occurred in the pond in **July**. Samples were collected and returned to the DES Limnology Center for analysis. A **beach advisory** was issued on **7/10/2009** notifying the public of the presence of potentially toxic cyanobacteria. The cyanobacteria were identified as ***Anabaena,*** potentially toxic cyanobacteria. Samples were collected regularly throughout the advisory period and the advisory was removed on **7/13/2009** after cyanobacteria concentrations fell to acceptable levels.

  Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased and favorable environmental conditions occur, such as a period of sunny, warm weather.

  The presence of cyanobacteria serves as a reminder of the pond’s delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the pond by eliminating lawn fertilizer use, keeping the pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface in high concentrations. Wind and currents tend to “pile” cyanobacteria into scums that accumulate in one section of the pond. If a fall bloom occurs, please collect a sample in any clean jar or bottle and contact the VLAP Coordinator.

- **Table 4: pH**

Table 4 in Appendix B presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the “Chemical Monitoring Parameters” section of this report.

The mean pH at the deep spot this year ranged from **6.36** in the hypolimnion to **7.07** in the epilimnion, which means that the hypolimnion is ***slightly acidic*** and the epilimnion is ***approximately neutral***.

It is important to point out that the hypolimnetic (lower layer) pH was ***lower (more acidic)*** than in the epilimnion (upper layer). This increase in acidity near the pond bottom is likely due to the decomposition of organic matter and the release of acidic by-products into the water column.

- **Table 5: Acid Neutralizing Capacity**
  Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the pond has been monitored through VLAP.

  Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.8 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

  The mean acid neutralizing capacity (ANC) of the epilimnion (upper layer) was **14.4 mg/L**, which is ***much greater than*** the state median. In addition, this indicates that the pond has a ***low vulnerability*** to acidic inputs.

- **Table 6: Conductivity**
  Table 6 in Appendix B presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **40.0 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

  The mean annual epilimnetic conductivity at the deep spot this year was **180.2 uMhos/cm**, which is ***much greater than*** the state median.

  The conductivity continued to remain ***much greater than*** the state median in the pond and tributaries this year. Typically, elevated conductivity indicates the influence of pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff, which contain road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

  We recommend that your monitoring group conduct stream surveys and rain event sampling along the tributaries with ***elevated*** conductivity so that we can determine what may be causing the increases.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

It is likely that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the pond. The most commonly used de-icing material in New Hampshire is salt (sodium chloride).

A limited amount of chloride sampling was conducted during ***2009****. Please refer to the discussion of* ***Table 13*** *for more information.*

Therefore, we recommend that the **epilimnion** and the **tributaries** be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

- **Table 8: Total Phosphorus**
  Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The total phosphorus concentration was ***elevated*** (**56, 49 and 82 ug/L**) in **Row Brook** this year. This station has had a history of ***elevated*** and ***fluctuating*** phosphorus concentrations. We recommend that your monitoring group conduct a stream survey and rain event sampling along this tributary so that we can determine what may be causing the elevated concentrations.

  The total phosphorus concentration was ***elevated*** **(44, 42 and 40 ug/L)** in **Launch Brook** this year on the **May, June and July** sampling events. The total phosphorus concentration was ***elevated*** (**46 ug/L**) in **Juniper Brook** on the **September** sampling event. Record summer rainfall likely increased stormwater runoff and nutrient loading to the tributary. As impervious surface cover increases in the watershed, stormwater runoff volumes increase. This transports phosphorus-laden stormwater into tributaries and eventually the pond. Efforts should be made in the watershed to reduce impervious surfaces and limit phosphorus sources such as fertilizer use, septic influences, agricultural impacts, and sediment/erosion control.

The total phosphorus concentration in **Howard Brook** was ***elevated*** (**54 and 39 ug/L**) on the **May and June** sampling events. The turbidity was also ***slightly elevated*** (**3.49 NTUs**) on the May sampling event. It is likely that watershed wetland systems released phosphorus-enriched water into the tributaries and ultimately into the lake.

The total phosphorus concentration in **Woodcrest Brook** was ***elevated*** (**110, 210 and 220 ug/L**) on the **May, June and July** sampling events. The turbidity of the samples was also ***elevated*** (**6.83, 2.48 and 5.72 NTUs**), which suggests that the stream bottom may have been disturbed while sampling or that erosion is occurring in the watershed. Rain event and bracket sampling were conducted at Woodcrest Brook in July. The phosphorus results were ***elevated*** in Woodcrest Brook 1 and Woodcrest Brook 2 (**270 and 240 ug/L**). Turbidity sampling was not conducted; however visual inspection of the samples identified a large amount of sediment indicating that erosion is likely occurring in the sub-watershed. We recommend additional bracket sampling and stream survey further upstream to identify any potential areas of erosion or sedimentation.

The total phosphorus concentration in the **Stoney Lane Drainage** was ***slightly elevated*** (**33, 35 and 33 ug/L**) on the **May, June and July** sampling events. The turbidity of the samples was also ***elevated*** (**9.56, 3.47 and 5.05 NTUs**), which suggests that the stream bottom may have been disturbed while sampling or that erosion is occurring in the watershed.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at **http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm**, or contact the VLAP Coordinator.*

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) collected during **2009**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and bottom-dwelling organisms. Please refer to the "Chemical

Monitoring Parameters" section of this report for a more detailed explanation.

During this year, and many past sampling years, the pond has experienced a lower dissolved oxygen concentration and a higher total phosphorus concentration in the hypolimnion (lower layer) than in the epilimnion (upper layer). These data suggest that the **process of *internal phosphorus loading* is occurring in the** pond. When the hypolimnetic dissolved oxygen concentration is depleted to less than 1 mg/L, **as it was on the annual biologist visit this year and on many previous annual visits**, the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. Since an internal source of phosphorus in the pond may be present, it is even more important that watershed residents act proactively to minimize phosphorus loading from the watershed.

Low hypolimnetic oxygen levels are a sign of the pond's ***aging*** and ***declining*** health. This year the DES biologist conducted the dissolved oxygen profile in **June**. We recommend that the annual biologist visit for the **2010** sampling year be scheduled during **July** so that we can determine if oxygen is depleted in the hypolimnion ***later*** in the sampling year.

- **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.

As discussed previously, the hypolimnetic (lower layer) turbidity was ***elevated*** (**3.66, 2.79 and 19.3 NTUs**) on the **June, July and September** sampling events. In addition, the hypolimnetic turbidity has been elevated on many sampling events during previous sampling years. This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by an easily disturbed, thick organic layer of sediment. Or, a layer of cyanobacteria were present at this depth. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The turbidity in **Howard Brook** was ***slightly elevated*** (**3.49 NTUs**) on the **May** sampling event.

The turbidity in **Stoney Lane Drainage** was ***elevated*** (**9.56, 3.47 and 5.05 NTUs**) on the **May, June and July** sampling events.

The turbidity in **Woodcrest Brook** was ***elevated*** (**6.83, 2.48 and 5.72 NTUs**) on the **May, June and July** sampling events.

The record summer rainfall likely washed unstable sediments into the **tributaries** from the nearby watershed.

If you suspect erosion in the watershed, we recommend conducting a stream survey to identify sediment erosion. We also recommend that your monitoring group conduct rain event sampling along this tributary. This additional sampling may allow us to determine what is causing the ***elevated*** levels of turbidity.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

- **Table 12: Bacteria (*E.coli*)**
Table 12 in Appendix B lists the current year and historical data for bacteria *(E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

The *E. coli* concentration was **very low** at the **Deep Spot** on each sampling event. Specifically, each result was **10 counts or less**, which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and 88 counts per 100 mL for surface waters that are designated public beaches.

The *E. coli* concentration was **low** at **Juniper Brook** on each sampling event. Specifically, each result was **80 counts or less**, which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and ***slightly less than*** 88 counts per 100 mL for surface waters that are designated public beaches.

The *E. coli* concentration was **low** at **Stoney Lane Drainage** on each sampling event. Specifically, each result was **60 counts or less**, which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and ***slightly less than*** 88 counts per 100 mL for surface waters that are designated public beaches.

The *E. coli* concentration was **very low** at **Row Brook** on the **May and July** sampling events. Specifically, each result was **5 counts or less**, which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and 88 counts per 100 mL for surface waters that are designated public beaches.

The *E. coli* concentration was **low** at **Launch Brook** on each sampling event. Specifically, each result was **90 counts or less**, which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches.

The **Howard Brook** *E. coli* concentration was ***elevated*** on the **May** sampling event. The concentration of **700** counts per 100 mL ***was greater than*** the state standard of 406 counts per 100 mL for recreational waters that are not designated public beaches. The *E. coli* concentration was also ***slightly elevated*** (**260 cts/100 mL**) on the **June** sampling event.

The **Woodcrest Brook** *E. coli* concentration was ***elevated*** on the **July** sampling event. The concentration of **640** counts per 100 mL ***was greater than*** the state standard of 406 counts per 100 mL for recreational waters that are not designated public beaches. The *E. coli* concentration was also ***slightly elevated*** (**290 cts/100 mL**) on the **June** sampling event. Rain event and bracket sampling were also conducted at Woodcrest Brook on **7/2/2009**. *E. coli* concentrations were ***slightly elevated*** (**290 and 210 cts/100 mL**), however were not above the state standard for surface waters. We recommend additional bracket sampling further upstream to help identify the bacteria source.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

- **Table 13: Chloride**
  Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl^-) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be

toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The **epilimnion** was sampled for chloride during each sampling event this year. The results were **34, 41, 33, and 32 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria. However, this concentration is ***much greater than*** what we would normally expect to measure in undisturbed New Hampshire surface waters.

The **Launch Brook** tributary was sampled for chloride on each sampling event this year. The results were **41, 30, 30, and 42 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria.

The **Howard Brook** tributary was sampled for chloride on each sampling event this year. The results were **13 and 14 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria.

The **Juniper Brook** tributary was sampled for chloride on each sampling event this year. The results were **42, 38 and 32 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria.

The **Stoney Lane Drainange** tributary was sampled for chloride on each sampling event this year. The results were **25, 20 and 22 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria.

The **Woodcrest Brook** tributary was sampled for chloride on each sampling event this year. The results were **69, 53 and 63 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria.

The **Row** tributary was sampled for chloride on each sampling event this year. The results were **71, 70 and 74 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria.

We recommend that your monitoring group continue to conduct chloride sampling in the **epilimnion** and in **Launch Brook, Juniper Brook, Woodcrest Brook and Row Brook** particularly in the spring during snow-melt and rain events during the summer. This will establish a baseline of data that will assist your monitoring group and DES to determine lake quality trends in the future.

In addition, if your group is concerned about salt use on a particular roadway, we recommend contacting the town road agent or the Department of Transportation to discuss the implementation of a low-salt area near the lake and/or its major tributaries. We also recommend that your group work with watershed residents to reduce the application of chloride containing de-icing agents to driveways and walkways.

Please note that chloride analyses can be run free of charge at the DES Limnology Center. Please contact the VLAP Coordinator if you are interested in chloride monitoring. In addition, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

- **Table 14: Current Year Biological and Chemical Raw Data**
  Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year "raw," meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

- **Table 15: Station Table**
  As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your pond, the biologist conducted a sampling procedures assessment audit for your monitoring group. Specifically, the biologist observed the performance of your monitoring group and completed an assessment audit sheet to document the volunteer monitors' ability to follow the proper field sampling procedures, as outlined in the VLAP Monitor's Field Manual. This assessment is used to identify any aspects of sample collection in which volunteer monitors failed to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an ***excellent*** job collecting samples on the annual biologist visit this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an ***excellent*** job when collecting samples and submitting them to the laboratory this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

USEFUL RESOURCES

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, DES Booklet WD-03-42, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, DES fact sheet WMB-10, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, DES fact sheet WD-SP-1, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf

How to Identify Cyanobacteria, DES Pamphlets & Brochures, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/cyano_id_flyer.pdf

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, DES fact sheet WD-BB-9, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-9.pdf.

Low Impact Development Hydrologic Analysis. Manual prepared by Prince George's County, Maryland, Department of Environmental Resources. July 1999. To access this document, visit www.epa.gov/owow/nps/lid_hydr.pdf or call the EPA Water Resource Center at (202) 566-1736.

Low Impact Development: Taking Steps to Protect New Hampshire's Surface Waters, DES fact sheet WD-WMB-17, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-17.pdf.

*NH Stormwater Management Manual Volume 1: Stormwater and Antidegradation, DES fact sheet WD-08-20A, (*603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20a.pdf

NH Stormwater Management Manual Volume 2: Post-Construction Best Management Practices Selection and Design, DES fact sheet WD-08-20B, *(*603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20b.pdf

NH Stormwater Management Manual Volume 3: Erosion and Sediment Controls During Construction, DES fact sheet WD-08-20C, *(*603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20c.pdf

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, DES fact sheet WD-SP-2, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf.

Road Salt and Water Quality, DES fact sheet WD-WMB-4, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf.

Vegetation Maintenance Within the Protected Shoreland, DES fact sheet WD-SP-5, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-5.pdf